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rods, and adjusted to suit the centre, as shewn at *ff*; but it will save time, and do the work truer, to have four rods, *b b* and *ff*, to hold the corner and centre stamps at the same time : for then one putting in the press does one side of a book, and all will be exactly alike, without the care of the workman. If the frame *a a* is made a little wider than the thickness of the stamp on the pattern side, it might be adjusted to touch the front edge of the book, which would keep the patterns quite straight and equidistant on all the books.

No. VII.

PLUMBAGO FOR CHRONOMETERS.

The GOLD ISIS MEDAL was presented to Mr. L. HEBERT, Queen Street, Chelsea, for his application of prepared Plumbago instead of Oil for Chronometers. The following Communication has been received from Mr. HEBERT, and a Sample of the Plumbago is in the Society's Repository.

SIR,

PERMIT me to offer you a few observations upon a subject which fifteen years of experience have produced ; namely, the substitution of plumbago for oil in the rubbing parts of chronometers, in order that they may be laid before the Society of Arts, and thus, if approved, become beneficial to the world at large.

The use of sidereal and mean-time pieces in observatories, at sea or on land, is to measure the motions of the heavenly bodies, and by them ascertain their right ascension in time, their distance from a given point, and to obtain the longitude of places upon the earth. From that the word *chronometer* (measurer of time) is derived ; but very few deserve that appellation. Whatever may have been the skill of the maker, and the care he took for their perfect construction, the observer must not expect to find them infallible ; and, however well regulated they were at first, they will not remain so permanently : their rate of going will be accelerated or retarded by the temperature of the atmosphere, which causes all metals to expand or contract, more or less, and that, in an irregular degree, will create a variation in their movements ; and though innumerable experiments have been tried to render them perfect chronometers, by composing pendulums or balances that might contravene the atmospherical influence, yet none has been found that would accomplish that desideratum ; because it is evidently proved, that metals, after having been worked several times by heat and cold, never return to their primitive state at the same temperature.

But, Sir, this is not the only difficulty chronometer-makers have to combat against : there is another powerful enemy, which is always baffling their success, and that is *oil*. The different degrees of fluidity and quality of that liquid are also great alterants of clock-movements : in hot climes it will become absorbed ; in cold weather it will congeal ; in both instances impede the freedom of motion. This, nevertheless, may be remedied by a substitute which I discovered about fifteen years ago ; and in order to befriend science, I will here name it, and explain the way

of applying it to time-pieces, for the benefit of those who do not mind a little trouble, and have patience enough to go through the process it requires. It is plumbago, which, when carefully used, will last a considerable time without the necessity of being renovated. But much depends upon its quality: it must be of the best, free from grits, and the tenderer the better: a spurious sort would endanger the holes and pivots, causing mischief, instead of preventing it. The purest I could procure was from Mr. Langdon, the first pencil-maker in London, (perhaps in the world,) Great Russell Street, Bloomsbury, who, after I had explained to him the purpose it was intended for, considered its choice of the utmost importance, and selected some of the best, which answered my utmost expectation. I applied it to my sidereal time-piece in January 1816. Since that time it has been cleaned three times without the plumbago being renovated: the friction places were only wiped with a fine muslin rag; and now, 1827, it goes as well as ever. I must beg leave to observe here, that I found then an insurmountable difficulty in charging the jewelled pallets of the escapement with the plumbago; but I obviated that by applying it to the friction-plane of the teeth of the swing-wheel; so, ever since, the clock has gone without oil.

The process of applying the plumbago is thus:—Take about a quarter of a pound of the purest black lead, the brighter the better; reduce it to a very fine powder in a metal mortar, and to judge if it is fine enough, take a small pinch of it between your fingers; after rubbing it a few seconds, if it does not feel lumpy nor gritty, but smooth and oily, it is good, and beaten enough; have a glassful of filtered water; take some of the powdered plumbago with the clean blade of a knife, spread it on

the water, and stir it well; cover the glass, and let it stand for two or three hours; at the top of the water will be a kind of cream, skim it off with a card, and lay it upon a sheet of paper; when dry, put it in a box, to exclude the dust from it; put the sediment aside; repeat the process with some other water and plumbago, until you have acquired a sufficient quantity of fine powder for your purpose; when the whole of the powder is dry, pound it again in the mortar, or bruise it with the bowl of a silver spoon, upon a clean sheet of paper, and repeat the same process two or three times; if the lead is pure, no more sediment will go down; if some does, wash and dry it once or twice more; as soon as no sediment remains, you may be sure that the plumbago dust is pure, and cannot cause any mischief to the pivots and holes; pour some alcohol (the strongest spirits of wine) into a small glass; having wiped the pivots of the wheels and the holes of the plates very clean, immerse them into the spirits, and immediately into the plumbago powder: they will be covered with it; take a small pencil brush, such as is generally used by miniature painters, dip it into the spirits, and fill the pivot-holes with it; introduce some powder into them with your finger, by rubbing the plates over the holes, till the powder is even with their surfaces; put in the wheel, and make it revolve in the frame for five or six minutes; do the same to every wheel, and also repeat it two or three times; then the holes and pivots will be charged with a thin crust of plumbago, smoother than any polish you can give them; the piece will go twice as long without cleaning as with oil; and truly, if its movement is entirely secluded from dust, there will be no necessity of cleaning it for twelve years, which will be about the time for renovating the plumbago.

The sidereal time-piece to which I have applied the plumbago was made with my own hands; and as its rate of going has been astonishingly good, and it is the only one of that construction ever seen, I will give you a short description of it. It goes eight days; the movement is not very different from others, except that the swing-wheel is at the bottom and outside of the plate, supported by a steel cock: the pivot-holes of the swing-wheel and the pallets are jewelled. The escapement is fixed upon the pendulum, and swings with it: its pallets are susceptible of a horizontal and a vertical adjustment by means of three screws; they lock and unlock the wheel at the diameter, or fifteen teeth: the vibration of the pendulum, between the unlocking and locking, is an arc of $1^{\circ} 10'$ upon the index plate, and the full swing $1^{\circ} 30'$, making *an ultra* of $10'$ of a degree on each side. The clock is fixed to a cast-iron plate, fastened on the back of the case, and is adjusted in beat by two screws, acting laterally. The pendulum, which has nearly the form of a pawnbroker's sign, is suspended upon a potence fixed at the back of the case: its perpendicular arm, seven inches long, rests upon a stud at the bottom, even with the pallets; its expansion is upwards, and acts as a compensation for the length of that part of the pendulum between the suspension and the pitching of the pallets into the wheel. Upon the horizontal arm of the potence, and over the slit, is a screw-nut, by which the pendulum is hung: it serves to adjust the depth of the pallets into the swing-wheel. The pendulum-spring is one inch broad, and its greatest flexibility is at the horizontal diameter of a hole three-quarters of an inch wide; below the spring, at about six inches and a half from its pliability, is a plate, to which is affixed the escapement, having a perpendicular slit in the

middle, wide enough to admit the cock of the swing-wheel through, and to let the pendulum vibrate: to that plate is screwed a steel rod, at the end of which slides the pendulum bob. Above that bob and from its sliding-piece branch two arms with elbows, having a slit at each end to admit the pivots of the two levers which support the thermometer bobs. On the steel rod is a brass tube, whose calibre is just wide enough to admit the rod and to slide freely over it: that tube is fastened to the rod at its upper end, and at its lower rests upon those of the two levers; so that, by its expansion or contraction, it causes the two thermometer bobs to rise or fall, whilst at the same time one acts in a contrary way, and consequently produces a compensation. Those bobs weigh three pounds each, including one pound of mercury in each of the phials inlaid at the back of them; they slide literally upon their respective levers to adjust the compensation. The time-bob weighs five pounds. The clock has no pulley: the weight itself, which is only ten ounces, acts as one. It has gone with five ounces during six months. When I had a fixed observatory in Vauxhall Walk, that clock was often proved eight or ten times a-day by the transits of the sun and stars, if the atmosphere permitted; and in the last six months, after all the improvements I deemed necessary were made; viz. from July 19th to February 24th, it never varied more than $9''\cdot8$ + in time, nor above $\frac{3}{100}$ of a second from its rate.

Such have been the happy results of my experiments; and I have no doubt that such exactness was owing, not only to the correctness of its compensation, but also to the stability of motion produced by the *plumbago*. I am aware that to those who are averse to care and attention, the above process will appear troublesome; but, Sir,

what is a day's labour once in ten years? Let those, then, whom the love of improvement and their own reputation stimulates, try it; I am confident that their endeavours will be crowned with success, and with the pleasure of having eminently contributed to the benefit of mankind.

I am, Sir, &c. &c.

L. HEBERT,

*Geographer at the Colonial Department,
3, Queen's Terrace, Queen Street, Chelsea.*

T. HOBLYN, Esq.

Vice-President, &c. &c.

No. VIII.

DETACHED ESCAPEMENT.

The Large SILVER MEDAL and FIVE POUNDS were presented to Mr. ROBERT MAY, New Road, Deptford, for his Detached Escapement: a Model of which has been placed in the Society's Repository.

THE difficulty is so great of effecting a completely detached escapement, in which the alternate impulses given to the balance shall be equal and independent of the train, that, notwithstanding its theoretical advantages, watch-makers have been driven to the necessity of abandoning it, and of equalising the oscillations of the balance by other means. The escapement invented by